

## CASE REPORT

# Rapidly expanding venous intracerebral haemorrhage with spot sign

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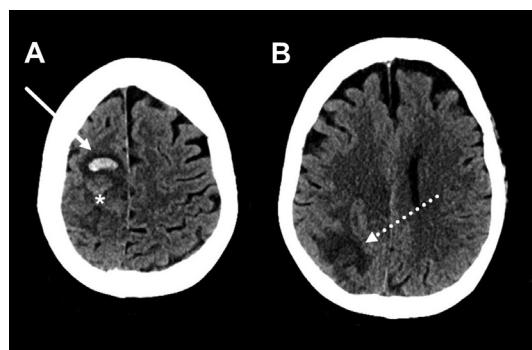
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## SUMMARY

A 79-year-old woman was brought to the hospital with an acute-onset left hemiparesis. On initial examination, she had a pure sensorimotor syndrome with left-sided weakness and sensory disturbance. Her mental status was normal. She had normal visual fields to confrontation and no neglect. Her initial CT and CT angiogram revealed cerebral venous thrombosis with associated haemorrhage. A 'spot sign' was visible on CT angiogram. Immediately following the CT scan, the patient had a rapidly progressive decline in level of consciousness, requiring endotracheal intubation. A follow-up CT scan 70 min later showed the haemorrhage had expanded dramatically, with mass effect, midline shift and herniation. After a discussion with the family, the patient was extubated and died the following day. This is the first case of a cerebral venous thrombosis with associated spot sign-positive haemorrhage and published clinical details that the authors are aware of.

## BACKGROUND

The finding of active contrast extravasation on CT angiogram in intracerebral haemorrhage (ICH) was first described in 1999,<sup>1</sup> and the term 'spot sign' was coined by another group in 2007.<sup>2</sup> Spot signs in primary ICH are thought to be due to ongoing arterial bleeding causing haemorrhage expansion.<sup>3,4</sup>



**Figure 1** (A,B) Selected axial images from a non-contrast CT scan at the time of presentation demonstrate (A) a small focal haemorrhage in the right mid-frontal aspect of the centrum semiovale (solid arrow), with more subtle areas of abnormality immediately posterior to it, likely representing hyperacute intraparenchymal blood (asterisk). (B) Low attenuation is seen in the white matter immediately inferiorly, in the right parietal region, representing oedema secondary to venous infarction (dashed arrow).

While a small proportion (2/34) of cases of secondary ICH due to cerebral venous thrombosis (CVT) were noted to have a spot sign in a recent case series,<sup>5</sup> the clinical details of the cases were not published. Haemorrhages associated with veno-occlusive disease are most often described as having a more indolent clinical course. We are not aware of the clinical details of a case of haemorrhage due to CVT with a positive spot sign in the literature; such a case is presented below. We hypothesise that a rapidly expanding haematoma, with a venous spot sign as a radiological correlate, may occur secondary to sufficiently impaired venous drainage with associated elevated venous pressure.

## CASE PRESENTATION

The patient was a 79-year-old, right-handed, First Nations woman evaluated in the emergency department for possible acute stroke.

Her medical history was significant for diverticulosis, iron deficiency anaemia and asthma. There was no history of deep venous thrombosis, pulmonary embolism or systemic malignancy.

While at home with her daughter, she noted a sudden-onset numbness in her left leg and foot, with progression over 1 min up to the left upper extremity and hand. Her daughter phoned paramedics, and by the time they arrived (15 min after symptom onset) she had developed left-sided hemiparesis. At that time, she was noted to be awake and alert. Her blood pressure was in the normal range.

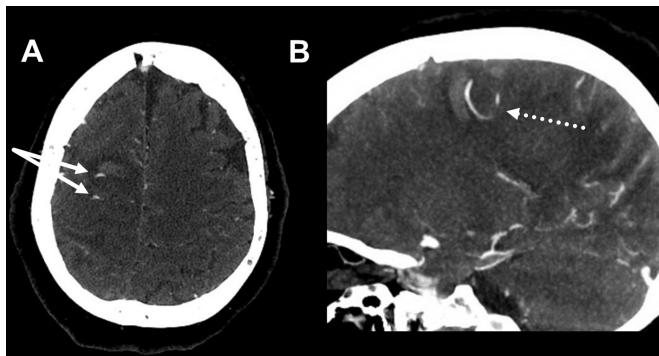
The patient arrived at our hospital 30 min following symptom onset. A brief neurological exam was performed while the patient was brought directly from the ambulance stretcher to the CT scanner. She was alert and appropriately answering questions. She had mild weakness of the left arm and leg, being able to lift both against gravity. She had mild sensory asymmetry with decreased light touch perception to the left arm and leg compared with the right.

By the time she was moved out of the CT scanner (15 min later), she had developed a neglect syndrome with head and eye deviation towards the right and progression of the hemiparesis to complete plegia of the left arm and leg. She did not blink to visual threat on the left.

Over the next few minutes she became progressively drowsier and was intubated for airway protection prior to a follow-up CT scan.



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**Figure 2** Axial source (A) and sagittal maximum intensity projection (B) images from a CT angiogram (venous phase) performed immediately after the initial non-contrast CT head examination demonstrate contrast extravasation, representing a venous 'spot' sign, in the areas of obvious and more subtle haemorrhage (solid arrow), with this seen as a more extensive site of active bleeding on the sagittal image (dashed arrow).

## INVESTIGATIONS

Figures 1–4 demonstrate the initial small haemorrhage, active extravasation of contrast, and superior and right transverse sinus thrombosis, as described in the captions. Figures 5–6 demonstrate subsequent expansion of haemorrhage, as described in the captions.

## DIFFERENTIAL DIAGNOSES

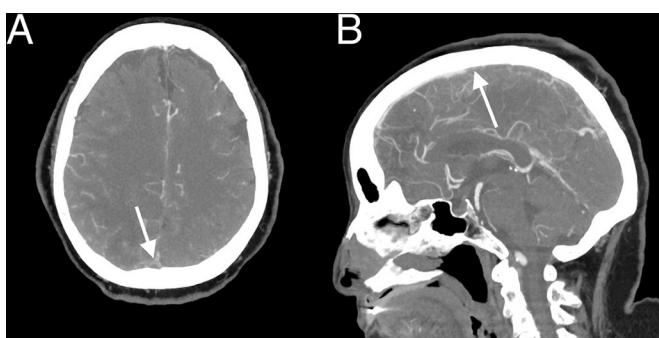
Imaging studies revealed multifocal venous sinus thrombosis and intraparenchymal haemorrhage. The differential diagnoses considered were acute CVT with venous haemorrhage, dural arteriovenous fistula secondary to chronic CVT, incidental chronic venous occlusion with primary ICH and coagulopathy in the context of venous haemorrhage.

## TREATMENT

Given the rapid clinical deterioration, no specific treatment was initiated. At the time of clinical deterioration, a discussion about the patient's wishes was undertaken with her daughter. After discovery of the hugely expanded haemorrhage, the patient's daughter requested palliation only.

## OUTCOME AND FOLLOW-UP

The radiological findings were consistent with CVT with associated venous infarction complicated by secondary ICH. No



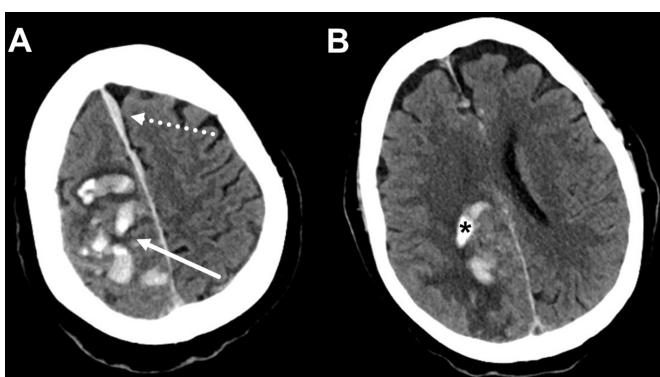
**Figure 3** Selected axial source (A) and sagittal maximal intensity projection (B) images from a CT angiogram performed immediately after the initial non-contrast CT head examination demonstrate non-opacification of the superior sagittal sinus distal to the anterior portion of the sinus, consistent with sinus thrombosis (solid arrows).



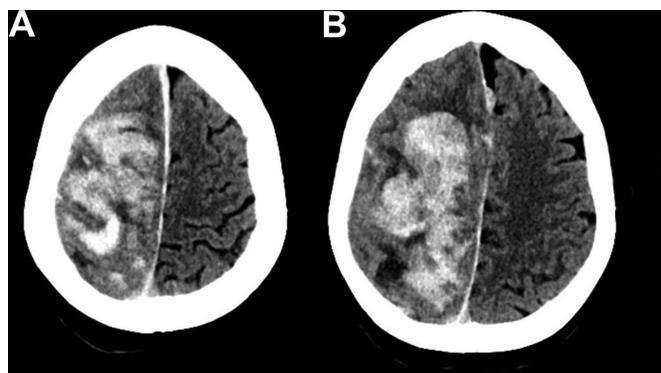
**Figure 4** Axial source image from CT angiogram performed immediately after the initial non-contrast CT head examination demonstrates non-opacification of the right transverse sinus, consistent with sinus thrombosis (solid arrow).

evidence of dural arteriovenous fistula was seen on post-hoc review of the images. The presence of associated venous infarction was not consistent with primary ICH. Given the rapid change in clinical course, coagulation-related blood work was not drawn prior to palliation. However, previous laboratory parameters, including international normalized ratio, partial thromboplastin time and platelets, were normal on the outpatient blood work performed 8 months prior to presentation.

Following discussion with the palliative care service, the patient was extubated and died the following day.



**Figure 5** (A,B) Selected axial images from a non-contrast CT scan performed approximately 9 min following the initial non-contrast CT (and following the CT angiogram) demonstrate (A) significant expansion of intraparenchymal haematoma in the right mid/posterior frontal and anterior parietal region (solid arrow), with additional development of an acute falcine subdural haematoma (dashed arrow). (B) Acute haemorrhage has also now developed in the deeper parenchyma, in the area of previously identified oedema (asterisk).



**Figure 6** (A,B) Selected axial images from a non-contrast CT scan performed approximately 70 min following the second non-contrast CT (after marked clinical deterioration of the patient) demonstrate (A) massive increase in the amount of intraparenchymal haemorrhage in the right cerebral hemisphere, with associated effacement of the adjacent cerebral sulci, and displacement of the falx cerebri left of midline. Additional uncal and transtentorial herniations were also present (not shown).

## DISCUSSION

CVT occurs most commonly in individuals with underlying systemic factors promoting a hypercoagulable state. However, a significant minority of CVTs have no identified cause, with different series describing 13%–29% of cases as idiopathic.<sup>6,7</sup> Approximately one third of patients with CVT have associated ICH.<sup>8</sup> The presence of ICH is associated with a more severe clinical presentation and worse prognosis.

The largest review of CVT with associated haemorrhage identified risk factors for poor outcome, including older age, male gender, deep cerebral venous system thrombosis, right transverse venous system thrombosis and presence of a motor deficit. This woman had several of these risk factors (older age, right transverse sinus involvement, motor deficit). We hypothesise that a venous spot sign in CVT-associated haemorrhage would be associated with a poorer outcome; however, this requires further study for confirmation.

The spot sign has generally been described in relation to arterial sources of active contrast extravasation. Careful review of the images in this case did not reveal an arterial source of bleeding.

## Learning points

- The spot sign predicts haematoma expansion in intracerebral haemorrhage.
- Cerebral venous thrombosis can rarely be associated with rapidly expanding intracerebral haemorrhage.
- A venous spot sign may be seen in intracerebral haemorrhage associated with cerebral venous thrombosis.

We conclude that elevated venous pressure due to impaired drainage of the cerebral venous system may be sufficient to result in rapid haematoma expansion with a *venous spot sign*.

**Contributors** CF was involved in the clinical care of the patient and wrote the manuscript. MKSH edited the manuscript and provided radiological images and captions. PT was involved in the care of the patient and reviewed the manuscript. TF edited the manuscript.

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